B. AMENDMENTS TO THE SPECIFICATION

Please replace paragraph [0003] with the following amended paragraph:

[0003] Conventional radiosurgery uses a rigid and invasive stereotactic frame to immobilize the patient prior to diagnostic CT (Computed Tomography) or MRI (Magnetic Resonance Imaging) scanning. The treatment planning is then conducted from the diagnostic images. The treatment planning software determines the number, intensity, and direction of the radiosurgical beams that should be cross-fired at the target, in order to ensure that a sufficient dose is administered throughout the tumor so as to destroy it, without damaging adjacent healthy tissue. Radiation treatment is typically accomplished on the same day treatment planning takes place. Immobilization of patient is necessary in order to maintain the spatial relationship between the target and the radiation source to ensure accurate dose delivery. The frame is fixed on the patient during the whole treatment process.

Please replace paragraph [0004] with the following amended paragraph:

[0004] Image-guided radiosurgery eliminates the use of invasive frame fixation during treatment, by frequently and quasi-continuously correcting patient position or aligning radiation beam with the patient target. To correct patient position or align radiation beam, the patient pose during treatment needs to be detected. This is accomplished by registering the X-ray image acquired at the treatment time with the diagnostic 3D (three dimensional) scan data (e.g., CT, MRI, or PET (Positron Emission Tomography) scan data) obtained pre-operatively at the time of treatment planning. The positions of the target are defined by physicians at the time of treatment planning, using the diagnostic 3D scan. The 3D scan data are used as a reference, in order to determine the patient position change during treatment. Typically, digitally reconstructed radiographs (DRRs) are generated from the 3D scan data, and are used as 2D (two-dimensional) reference images. Similarity measures are used to compare the image intensities in the x-ray

images and the DRR images, in order to determine the change in the position of the patient and the treatment target. In the field of medical image registration, this problem is categorized as a 2D/3D registration.

Please replace paragraph [0013] with the following amended paragraph:

[0013] Means are provided for generating a set of 2D DRRs for each x-ray projection image. The DRRs are based on the 3D scan data, and generated using the known intensity, location, and angle of the imaging beams. Processing means are provided for registering the DRRs with the x-ray images. The processing means include a processor for computing a set of 3D transformation parameters that represent the change in position of the target between the 3D scan and the near real time x-ray images. The processor includes software for performing a 2D/3D registration algorithm that includes estimating in-plane and out-of-plane transformation parameters for each projection, using a number of search methods including 3D multi-level matching, 2D sub-pixel matching, and 1D searching, and using two different similarity methods (~~sum-of-square~~ sum of absolute differences ("SAD") and pattern intensity) at different phases of the registration process. The radiosurgical system also includes ~~including~~ positioning means, responsive to a controller, for adjusting in near real time the relative position of the radiosurgical beams and the target, in accordance with the 3D transformation parameters obtained by the 2D/3D registration process.

Please replace paragraph [0028] with the following amended paragraph:

[0028] For projection A, given a set of reference DRR images which correspond to different combinations of the two out-of-plane rotations (r_A, ϕ_A), the 2D in-plane transformation [[(x_A, y_A, ϕ_A)]] (x_A, y_A, θ_A) can be estimated by the 2D image comparison. Determining the two out-of-plane rotations [[(r, θ_B)]] (r, ϕ_B) relies on which reference DRR is used for an optimal similarity match. Similarly, the 2D in-plane transformation (x_B, y_B, θ_B) and the out-of-plane rotations (r_B, ϕ_B) can be estimated for projection B.

Given the results $(x_A, y_A, \theta_A, r_A, \phi_A)$ for projection A and $(x_B, y_B, \theta_B, r_B, \phi_B)$ projection B, the 3-D transformation can be obtained by the following expressions

$$x = (x_A + x_B)/2, y = (y_A - y_B)/\sqrt{2}, z = (y_A + y_B)/\sqrt{2},$$
$$r = (r_A + r_B)/2, p = (\theta_B - \theta_A)/\sqrt{2}, w = (\theta_B + \theta_A)/\sqrt{2}$$